Influence of aging on the mechanical behavior of bonded assemblies

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For automotive industry, the use of bonded assemblies is a promising solution in order to reduce the vehicle's weight, and thus to decrease the CO_2 emissions and energy consumption. To guarantee the safety of passengers, in particular in crash situations, the understanding of aging effects on the physico-chemical properties and on the mechanical behavior of these assemblies remains a key point. In literature, many authors have studied the influence of aging on the mechanical strength of adhesive assemblies under quasi-static loading while varying the aging conditions [1, 2].

In this work, a specific accelerated hygro-thermal aging experimental method is used to characterize three adhesives dedicated to crash applications: 3M™ Scotch-Weld ™ 2216, Permabond Loctite ESP110 and DOW® Betamate™ 1496V. This method allows the quick determination of the evolution of the glass temperature and of the water absorption during the aging process.

The evolution of the mechanical strength of single lap joint specimens is characterized before and throughout the aging process, under both quasi-static and dynamic conditions. For that purpose, the tests are performed on standard hydraulic testing machines and on a dedicated weight drop tower using different loading speeds from 2 m/s to 8 m/s [3].

The major observed tendencies of aging on mechanical behavior are discussed.

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